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Of our country's many million homes, more than 1 out of every 10 are out-and-out slums. Nearly one-half of all American dwellings are in poor to "fair" condition, and urgently need basic repairs.

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How do slums start? Usually just one house starts to slide downhill and soon a whole block changes. Pride is lost. Other houses are neglected, decay spreads.

So the 20 million homes in need of basic repair and improvements deserve equal attention. The time to stop the spreading blight of slums is *before it starts.*

What's your stake in stopping slums?

If you think your town is different, just look around you . . . If you think slums only affect persons who live in them, think again.

Slums raise taxes and lower property values of the whole town. They raise rates of crime, delinquency and disease. *Everyone* has a real stake in stopping slums. And *that includes you as a businessman.*

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What can your firm do? The answer to America's housing problems starts with individuals. But to roll back slums is such a big job it's going to take more than individual effort. It will need the cooperation of your business and many others.

Some slums should be torn down and a fresh start made. Others can be remodeled and made to conform to better living standards. So it is up to you to support every sound program which seeks adequate housing for all our people.

New help is now available

There is a new national, non-profit organization called A.C.T.I.O.N.—The American Council To Improve Our Neighborhoods—which is designed to help all individuals or groups interested in putting America's house in order.

Send for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It lists booklets, research, check-lists, and other material which can help you. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

American Council To Improve Our Neighborhoods

ceanographic Survey f Albacore Grounds

The 130-foot converted tuna clip- r *Hugh M. Smith*, Honolulu-based eanographic and fisheries research ip of the U.S. Fish and Wildlife rvice, returned to port on August , successfully completing a 6-week drographic and biological survey the North Pacific, it was announced Dr. A. L. Tester, POFI director.

The cruise, which extended as far st as Midway Island and north to thin 50 miles of the Aleutians, was ie step in a continuing, large-scale ogram aimed at development of w fishing grounds for albacore na north of the Hawaiian Islands. had as its immediate objective the thering of information on the phys- al, chemical, and biological char- teristics of the ocean water which ill serve to guide subsequent experi- ental fishing by the Service research ips.

This cruise of the *Smith* was coor- inated with the work of vessels of ie Pacific Oceanic Group (Canada), ie University of Washington, the cripps Institution of Oceanography, id the California Department of Fish and Game in an international cooperative operation planned to provide a simultaneous survey of the entire North Pacific. Japanese research vessels also cooperated.

Scientists aboard the *Smith* collected water samples for chemical analysis and water temperatures from the surface down to depths of 3,000 to 8,000 feet at 78 locations. At each of these stations fine-meshed nets were hauled to collect samples of zooplankton, the small animals which contribute directly or indirectly to the nourishment of the tuna and other large fishes. Hauls with larger nets were also made each night to capture the small fish upon which albacore feed, and dip-net collections under lights were made at all night stations where sea conditions permitted.

Although complete results will not be known for some time, preliminary shipboard analyses showed that the zone of biologically rich water where the warm North Pacific Current and the cooler Aleutian Current mingle was much farther to the north than on two earlier cruises made to the area by POFI vessels during the winter. Its winter position has been 800 to 1,000 miles north of Hawaii, but on the recent cruise it was found to be 1,400 to 1,600 miles from the Islands. As on previous cruises, the trolling lines fished on the runs between oceanographic stations took albacore only within this zone of current mixing.

Two Species of Bonito

A recent Bulletin of California Department of Fish and Game, Marine Fisheries Branch, gives final portion of a series of descriptions of the tunas and tuna-like fishes of the Pacific. It describes two species of bonito, the Peruvian and the Oriental. One of the most abundant sources of protein food is found in the "Scombroid" group of fishes, including tuna, skipjack, bonito and mackerel.

If fishing resources are to be intelligently exploited, management will require a precise knowledge of the composition of the total stock and the geographical range of the component species. The information obtained from this study is presented as a further contribution towards the eventual understanding of the stocks of tuna-like fishes and the relationships of the stock from different areas.

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In Washington State . . .

MORE FISHWAYS

THE State Department of Fisheries is nearing completion of the largest fishway construction program, not associated with water power development, ever undertaken by Washington State.

Eleven fishways have been built or are scheduled for completion next year. Construction of a twelfth unit of the current escapement and rehabilitation program at Sunset Falls on the Skykomish River should start in 1956. These fishways are in addition to large fishway systems built or scheduled for construction on the Columbia and Snake Rivers to pass fish over hydroelectric dams.

The laddering of blockaded Washington rivers and streams will add an estimated $1,000,000 yearly to the State's sports and commercial fishery in the next 10 to 15 years.

The program of stream rehabilitation, "Operation Cleanup," was started in 1951 with funds appropriated by the State Legislature. Enlarged in 1952-53, and augmented by the Federal Government under the Lower Columbia River Fisheries Development plan, the program will carry over until at least 1957.

The program has three major objectives.

1. To make accessible as soon as possible many miles of potential salmon spawning and rearing grounds.

2. To compensate for spawning areas lost because of power dams or other man-made obstructions.

3. To keep these areas open and in a useful condition.

The dedication of the Granite Falls fishway on the Stillaguamish River this fall officially opened the latest of the Department's laddering projects.

The 580-foot vertical baffle (Hell's Gate type) fishway was constructed at a cost of $300,000. The salmon will enter a 285-foot tunnel bored into a rock cliff after passing through the fishway, bypassing a series a cataracts about 50 feet in height. Pink salmon and a few spring chinook already have ascended the fishway enroute to the 30 miles of spawning grounds located above Granite Falls.

Other fishways completed or nearing completion included:

Deschutes River—Total length of the three unit, 840 feet; rise, 88 feet; cost, $300,000.

Wind River—Length, 460 feet; rise, 46 feet; cost, $325,000.

Klickitat River — Two fishways, lengths, 150 and 57 feet; rises 12 and 6 feet; cost, $115,000.

Kalama River—Length, 300 feet; rise, 24 feet; cost, $180,000; to be in operation next fall.

Delameter Creek (Cowlitz River) —Length, 260 feet; rise, 22 feet; cost, $50,000.

Salmon Falls (Washougal River) —Length, 108 feet; rise, 13 feet; cost, $100,000; under construction.

Coweman River—Length, 30 feet; rise, 6 feet; cost, $8,000.

All construction is of the Hell's Gate type with the exceptions of Delameter Creek which has horizontal weirs and the Coweman River which is of the new "herring bone" Denil type.

Laddering of Sunset Falls on the south fork of the Skykomish River, scheduled to begin in 1956, will cost $350,000. The Skynomish River program calls for two more projects to be built, the Canyon and Eagle fishways, at a cost of $400,000.

The overall stream improvement program is also recapturing river and stream areas for salmon spawning.

Before the advent of modern logging methods, the most economical way to transport logs to the mill was by water. A system of log dams to maintain ponds for holding the logs and to create a supply of water to move the cut timber was constructed in the timberlands of southwestern Washington.

Many of these "splash, roll and pond" dams were total blocks to salmon, thus depleting fish runs by blockading many miles of spawning grounds.

The Fisheries Department has been blasting or destroying by other means many of these antiquated structures. Crews recently removed a splash dam on the west fork of the Naselle River in Pacific county and a second dam on Delezene Creek, a tributary of Chehalis River. Others have been moved from the West Hoquiam Riv North River, and Willapa River.

Another phase of stream impro ment work is the removal of mi obstructions, such as log jams a beaver dams, blasting of small fa to make them passable, and culv construction work.

Canned Foods and Bomb

If an atomic bomb strikes y community, it's likely that the c ned foods on your kitchen shel would still be safe to eat.

And the extra supplies of can foods that you keep in your ba ment can be expected to survive atomic blast even better than y house.

So states Dr. Carlos Campb Executive Secretary of the Natio Canners Association, Washington, C., in a report on the civil defe tests on canned foods conducted part of the big atomic experime in Nevada last spring.

Dr. Campbell said that tin glass-packed foods came through tests undamaged except for perfo tions caused by flying missiles, e as close as 3,750 feet from the bl

STATEMENT OF THE OWNERSHIP, M AGEMENT, CIRCULATION, ETC., REQUI BY ACT OF CONGRESS OF PAN AMERI FISHERMAN, PUBLISHED MONTHLY ORANGE, CALIF., FOR OCTOBER 1,
State of California)
County of Orange) ss.

Before me, a notary public in and for the and county aforesaid, personally appeared B Sando, who having been duly sworn accordin law, deposes and says that he is the publishe Pan American Fisherman and that the follo is, to the best of his knowledge and belief, a statement of the ownership, management, etc the aforesaid publication for the date shown i above caption, required by the Act of Augus 1912, as amended by the Acts of March 3, and July 2, 1946, embodied in section 537, P Laws and Regulations, to wit:

1. That the names and addresses of the lisher, editor, and business managers are: lisher Briant Sando; Editor, Robert K. La Manager, Briant Sando, Orange Savings B Orange, Calif.

2. That the owners are Briant Sando and M. Sando, Orange Savings Bldg., Orange,

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Sworn to and subscribed before me this 30t of September, 1955.

Clyde Newton, Notary
(My commission expires January 21,

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ABLE OF CONTENTS

	PAGE
tore Fishways for Washington State	4
he Tuna Industry in Australia	6
eport from Washington, D. C.	7
he Publisher's Page	9
Vhy Do Fishery Stocks Fluctuate?	10
rolling Around the Central Pacific Islands	12
ird Flocks and Fish Schools	13
California's Elusive Sardines	14
he Globe	17
una Problems Aired	20
OFI Activities	23

About This Issue . . .

"IF it ain't one thing it's a couple of others," according to Amos 'n Andy. So with the recent public hearings on fishery problems. In Alaska they were mainly concerned with salmon; in Seattle and San Francisco with ship building; and in San Pedro with tuna . . . see "Tuna Problems Aired" on page 20.

*

In mid-October Federal and State officials met with fishing industry representatives in Washington, D. C. Main purpose was to draft articles for submission to various governments covering codes of the International Law Commission on fishing and territorial waters.

With many tuna boats idle for as long as three months, quite a problem arose among the fishermen; they are not eligible for unemployment insurance . . . and that makes a difference!

*

Now that the canneries are back at work, it is good to watch fishermen unloading their tuna boats—long tied up at San Pedro and San Diego — see "The Publisher's Page" on page 9. In October Harold Cary, manager of the American Tunaboat Association, said that "the amount of fish lying in refrigerated holds of idle tuna clippers is the largest in the history of the industry."

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The Tuna Industry In Australi

IN Australian fishing and fish canning circles there is an air of expectancy, a feeling that something important will happen soon on the tuna front. Many are inquiring about boats, costs and markets.

But the question is not infrequently asked, "What is retarding the development of a tuna industry in Australia?" The writer does not pretend to know the answers. The purpose of this article is to look at some economic aspects of the matter.

The factors affecting fisheries development in Australia are much the same as those which apply in other countries. The general background of fisheries development is well stated in the F.A.O. Monthly Bulletin of Agricultural Economics and Statistics:

"Fishing has never been an attractive investment object in the ordinary capital market. It may be that fishing, looked at from the investor angle, appears to be even more of a gamble than it really is . . . The formation of regular commercial companies has usually evolved from the skipper-owner stage through various forms of family ownership, eventually taking the form of private or public companies . . . Recent developments such as wage agreement, contract prices, etc., have stabilized remuneration in some sections, but payment by share of the proceeds is still the common practice all over the world."

It can be expected that ordinary investment capital for the Australian tuna industry will be scarce, and that development will come by stages on the initiative of owner-operators, perhaps with some assistance from cannery companies, or by cannery companies organizing fishing enterprises themselves. A possible alternative is Government action to foster development by providing the necessary capital, in whole or part, for a full-scale commercial operation to demonstrate the profitability of tuna fishing.

But it is most likely that development will follow the Californian example fairly closely. Commencing with small boats fishing seasonally in local waters, it is probable that operations will extend over wider areas with larger boats until year-round deliveries are achieved.

By F. J. KEARNS
Senior Research Officer,
Commonwealth Fisheries Office

Boats

The Californian industry depends primarily on steady catching of yellowfin and skipjack (our striped tuna) throughout the year by the clipper fleet, pole fishing with live bait. Long-lining, as practiced by the Japanese, also produces huge quantities of fish all the year round. It could conceivably be used by Australians but it is so far essentially a Japanese system. It is assumed that any large scale development in Australia will be based on pole fishing with live bait, as other methods, such as trolling and netting, can be employed only seasonally and locally.

It is highly probable that Southern Bluefin, Striped or Yellowfin tuna could be taken by live bait boats throughout the year. The Japanese catch skipjack and other species by long-lining over a large part of the Pacific Ocean, including the vicinity of the Solomon Islands (about 1600 miles from Sydney). Investigation of the Coral Sea and other northern waters, combined with seasonal availability of Southern Bluefin in temperate waters, would probably show that a steady year round flow of fish could be expected.

Fishing has been mostly confined to the Southern Bluefin and Striped tunas, and proof of the commercial possibilities of others is still lacking. With the range of a big clipper (3000-4000 miles), however, much of the South-Western Pacific, even beyond Samoa (about 2,360 miles from Sydney) is within its scope.

In California, small boats continue to contribute an appreciable proportion of cannery receipts by exploiting local seasonal occurrences. During off-seasons they switch to other types of fishing. It seems probable that such general purpose vessels will always have a place in the Australian tuna industry; but if a big industry is to develop, larger, specialized tuna boats able to catch tuna all the year round will be the mainstay.

For such long range vessels the design can be expected to follow the general pattern of the clippers, b the most economical size of the v sels will not be determined until t cruising range necessary to reach t fish has been ascertained. It see probable, however, that year rou fishing will be found closer to ho than in the case of California.

Wages

From the point of view of an inv tor, the proportion of the gross p ceeds paid to crews in California m seem excessive. It is certain, howev that essentially the same system w be necessary in Australia and t Australian captains, engineers a crew members of bait boats will quire substantial incentive payme

In California, however, voya last up to three months and payme made to Californian crews incl incentives to entice them from advantages of shore life for such l periods.

In Australia, in the earlier sta particularly, voyages may be pected to be of very much sho duration, not only because fish likely to be available nearer ho but because fish-hold capacity of v sels will be much smaller. Co quently crew members may be lu to catch fish on a somewhat sma proportion of the gross takings.

It may happen, however, that w less lost time moving to and fr fishing areas, crews would fare q favorably, compared with their C fornian counterparts, on a lesser p centage.

Markets

With the present scale of proc tion, markets are not a problem. if production were multiplied by f or ten, would the same conditions easy disposal apply?

Costs of producing canned tuna Australia are probably the high in the world after U.S.A. The Un Kingdom is taking our canned t at present and a recent report fi London shows that there is a la unsatisfied demand, import licens from non-Commonwealth count being restricted to a global qu

The domestic market is of co rapidly expanding with the rise population. Very little tuna has e

(Continued on page

Report from Washington

Items Gleaned from the Nation's Capital

FISHERIES CONVENTION IN JAPAN.--The third meeting of the International North Pacific Fisheries Commission is in session now, having convened in Tokyo October 31. It was preceded by a meeting of the Commission's Standing Committee on Biology and Research beginning October 25. Many important matters are being discussed.

Attending from the United States are Commissioners Edward W. Allen, Seattle; Milton E. Brooding, San Francisco; John H. Clawson, Anchorage; and John L. Farley, Washington, D. C. Others are Clarence Anderson, Juneau; Clinton Atkinson, Seatttle; Richard S. Croker, Sacramento; Larry Fitzpatrick, Juneau; Francis Fukuhara, Seattle; William C. Herrington, Washington, D. C.; Robert C. Kallenberg, Dillingham, Alaska; Donald P. Loker, San Pedro; Harold Lokken, Seattle; Robert Parker, Juneau; Thomas F. Sandoz, Astoria; William Terry, Washington, D. C.; William F. Thompson, Seattle; Lowell Wakefield, Seattle; Lionel A. Walford, Washington, D. C.

--o--

TRADE AGREEMENTS IN COURT.--In United States Customs Court in New York City last month, arguments were heard in the suit brought in behalf of the California tuna industry. This challenged the constitutionality of the Trade Agreements Act of 1934.

As announced when the suit was filed last May, the action was instituted by Star-Kist Foods, Inc. Because it contends that the Trade Agreements Act delegates unconstitutional powers to the President, the case is said to resemble that of the famous ruling of the Supreme Court in the Schechter poultry case vs. Roosevelt's old NRA.

The present case, described as one of the most important ever to be tried before the New York Court, claims that the duty was illegally reduced from a tariff of 25 per cent to 12½ per cent on canned tuna fish. The latter rate, it is claimed, should apply only on imported tuna packed in brine.

--o--

DECISION IN 60 DAYS.--At the New York trial, attorneys for Star-Kist sought to establish that the Customs Court had jurisdiction to hear the case. One of the requirements was that the case must be filed by a "manufacturer, producer or wholesaler . . . of a class or kind of merchandise manufactured, produced, or wholesaled by him."

Donald P. Loker, Star-Kist vice president, and J. G. Sheerer, vice president in charge of sales and advertising, were put on the stand to present evidence that the company produces tuna fish packed in oil and in distilled water, in hermetically sealed tins, and that these products are of the same class and kind as the imported tuna fish packed in brine.

Attorneys for the U.S. government moved to dismiss the case on the ground that Star-Kist had failed to prove that it was a manufacturer, producer or wholesaler of the same class or kind of merchandise as tuna packed in brine. This motion was taken under advisement by the Court. The government was given 30 days in which to file a brief setting forth its position, and Star-Kist attorneys were granted an additional 30 days in which to reply.

If the government's motion to dismiss is granted, Star-Kist attorneys plan to appeal to the U.S. Court of Customs and Patent Appeals. If the government's motion is denied, Star-Kist attorneys will be granted 30 days in which to brief the constitutional question and the government will be allowed 30 days for a reply.

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U.S. REIMBURSES SUN PACIFIC, INC.--The U.S. Treasury reimbursed the San Diego tuna fishing firm, Sun Pacific Inc., for $12,000 in fines paid to the Ecuadoran Minister of Economy for release of the firm's tuna vessel "Sun Streak," seized in September 1954 off the Ecuadoran coast.

This was the first payment made by our government under the "Fishermen's Protective Act" (Public Law 680) signed by President Eisenhower on August 27, 1954, with the endorsement of the American fishing industry. This law provides for reimbursement of the owner of the vessel for costs incurred because of seizure by a foreign country on the high seas or in areas which the United States does not consider to be within the territorial waters of a foreign country, provided that there is no dispute as to material fact.

The "Sun Streak" was seized on September 4, 1954, when she was on a routine fishing voyage approximately 38 miles off the coast of Ecuador. After five days of detention in Quayaquil, Ecuador, the American vessel was released upon payment by the owners of a $12,000 fine.

It is understood that claims are being submitted on behalf of the owners of the "Arctic Maid" and the "Santa Ana" for similar arrests by Ecuadoran authorities early this year at which time the owners of the vessels paid the Ecuadoran government fines of $43,481.20 and $5,881.10 respectively.

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FWS BOOSTS TUNA.--Secretary of the Interior Douglas McKay not only supported National Tuna Week, November 3-12, but also urged consumers to giv special attention to this favorite fish food before and during Thanksgiving, Christmas and New Year's festivities. The Fish and Wildlife Service is cooperating in the program.

Tuna is especially recommended for winter diet both from its nutritional value and from the ease with which it is converted to a main dish or an appetizing snack. It is one of the "on hand" foods which can be used on any occasion.

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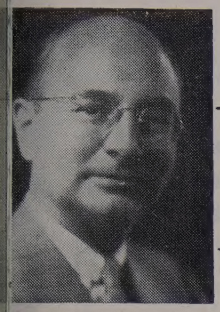
SCHOOL LUNCH PROGRAM AIDS.--Over 10 million school children are eating in school lunchrooms throughout the country. This affords an excellent oppor

(Continued on page 2



The Publisher's Page

anneries Back in Business.—A long period of famine for ost of the tuna fleets in San Pedro and San Diego ended e latter part of October, when the canners resumed erations after being closed down by union disputes d strikes.

First cannery to receive fish last month was the estgate-California Company in San Diego. It employs out 600 people, and according to company president mes B. Lane its closure was partly for repair and main-nance work as well as the labor situation. Its first car-es of tuna came from the large refrigerated mother ip, Puerto del Sol, with 800 tons from a fleet operating f Peru; and 270 tons from the San Diego based clipper, lphecca.

All other canneries in San Pedro and San Diego are ack at work after being closed for more than a month y strikes of AFL Cannery Workers and Steam Boiler ngineers. The strike's end was signalized in San Diego October 31 by unloading two vessels that had been in ort for nearly four months—the Star Crest and the Vest Point . . . for the Van Camp Sea Food Co., which ad the largest number of vessels tied up in San Diego larbor.

trike Results.—Van Camp closed down in San Diego eptember 8 when the engineers walked out, demanding arity with whatever pay scale was determined in the an Pedro area. This was settled on a basis of 52 hours ay for a guaranteed 48-hour week . . . at $140.40 a eek for the chief engineer and $122.20 for the watch ngineers.

When the tuna boat unloading began in San Diego, Harold Cary, manager of the American Tunaboat Asso-iation, said that more than 26,000 tons of fish, worth nore than $7,000,000 were in tunaboat holds. He expects ll to be unloaded by Christmas—which will go a long ay towards improving the Holidays for everybody in he tuna industry.

One of the strangest things in the whole U.S. business cene these days is the present position of this industry. Here is one of the important American table foods, and vital part of the economy of the State of California, n serious trouble while almost all other types of busi-ess are attaining new highs. It is a screwy situation.

Rose-Colored Glasses.—Out here in the West, and espe-ially where we're located in Southern California, it is easy o see that general business is moving along in mighty good style. Mostly it is going great, all right all right, but many other places are booming too.

We just returned from a trip through the mid-west and East, and leading cities from Los Angeles to New York show important signs of new homes, new factories, new highways, and new highs in business and employment. Once in a while we heard somebody say, "The bubble is getting too big; before long we'll have another bust." But such opinions are pretty scarce.

As long as the biggest and best managed companies in America continue to expand, spending more and more millions for plants and equipment, we're willing to follow their judgment. And that judgment is that this is no bubble; this is sound prosperity, based on a healthy economy that is expanding to match the increase in population and the higher standards of living now opening up to people all over the world. All this is bound to mean better times, eventually, for all fisheries interests.

Those Russian Visitors.—Various delegations have been visiting points of interest all over America. They saw some eye-popping things from New York to California—great farms, factories, machinery and production.

The U.S. delegation which in turn visited Russia did not return with such glowing reports. They saw some interesting things, but they didn't learn much that was new. Mainly the trip confirmed what the public has suspected all along—that Russia still has a long way to go . . . in most things except sabre rattling.

Now there is criticism in some quarters about letting the Russians see what we are doing and then go back home to copy our methods. For example, "Why should we let them learn the capitalistic methods which they decry? Obviously free enterprise has made this country flower while their system, undiluted, withers everything it touches. If the delegations learn too much over here, we will simply be digging our own graves. Russia as a nation can not be trusted, so why not let them flounder around?"

The other side of the argument is that we should help open the eyes of the communists—even to helping feed and clothe the victims of their tyrannies—in order to win their friendship and help improve the whole world. "You pay your money and you take your choice."

While There's Life There's Hope.—There's a story going the rounds "back East" that tells better than thousands of words why so many conferences, so much negotiating, such endless yakety-yak is going on everywhere . . . in business, in politics, in government, in union-labor affairs.

In a Middle Eastern country ruled by a Shah, an unfortunate but ingenious prisoner was discussing with his fellow prisoners—all about to be executed—some way by which he could escape having his head chopped off.

"If I could only get a reprieve for a single year," he said, "I would promise the Shah that in one year I would teach his favorite bull to fly."

"But," said one of the other prisoners, "the rest of us are to have a merciful death. It will be over in an instant, while you—if you fail to teach the bull to fly—will die a thousand deaths under torture. So better not try it."

"Oh, I don't know about that," replied the scheming prisoner, "lots of things can happen in a year. In the first place, the Shah might die. In the second place, I might die. In the third place, the bull might die—and, perhaps, who knows, maybe in a year's time I might just possibly teach that bull to fly." —BRIANT SANDO

This Is a Riddle: Why Do Fishery Stocks FLUCTUATE?

By L. A. WALFORD
Chief, Branch of Fishery Biology,
Fish and Wildlife Service

MANY of you are concerned about the condition of your fishery stocks, several of which seem to have receded to a low ebb of abundance in recent years. You are asking what has happened to pink salmon, to Alaska herring, to Maine sardines, to the Pacific sardine, to the Gulf of Mexico shrimp. Are there fewer of them in the sea? Or have they perhaps retreated to distant, more obscure areas and become less accessible to fishermen?

Whatever the nature of the condition may be, is it permanent? It is not only Americans who are concerned with these questions. So are people in other parts of the earth, for comparable conditions have occurred elsewhere, not only in California, Maine and Alaska, but also in such distant and widely separated places as Japan, India, Spain, North Africa.

Is this all the result of mere coincidence? Could any important part of this effect have sprung from some common cause impelled by such a cosmic influence as weather, for example, which might affect these diverse species in a similar way? Are all these recent and current seemingly peculiar conditions within the range of normal variation?

That last question is most important, because the seriousness of present conditions can be judged only in comparison with some standard; and that standard, which we call the normal, cannot be simply defined.

In the language of our everyday conversation, the word "normal" tends to have the rather fuzzy meaning of things-as-they-should-be. Lucky is the "perfectly normal man." There is nothing wrong with him. It will be a fine thing when "the country gets back to normal again," when our domestic and international problems have become resolved. When enough food is produced to feed the millions of hungry people of the world, they can enjoy "normal lives." Those are conceptions we hear on every side. In its popular connotation, normal is the good state of affairs, the good life. In the language of the statistician, it is something quite different—not nearly so cheerful a word, but very much more exact. It is simply the average, the sum of all the items divided by the number of items—the lean years and the fat, the good and the bad, the tall and the short—whatever it may be that we are talking about.

We are talking about fishes and invertebrate animals that happen to be commercially useful for canning. Exact information about the history of these species is limited to relatively few recent years when they have lived under the pressures of intense fisheries. We know nothing about their fortunes under virgin conditions. In those days, did they go through alternating periods of great abundance interspersed with periods of contrasting scarcity? What was their normal life then? We cannot tell. A great part of what we can learn now we must deduce from the catches of fishermen. Thus, in searching for normal patterns about the complex lives of fishes in order to understand the significance of events in a single year like the last, we must take into account patterns in the complex affairs of men. The behavior of fishermen fluctuates in response to economic conditions; and for that reason as well as others the intensity of fishing rarely remains constant long. Fishing techniques improve, fishing fleets increase in size, and markets change. And because recorded history about these aspects of fisheries is usually exasperatingly fragmentary, it is difficult to draw absolutely certain conclusions about normal conditions of fish or of fisheries. This much, however, seems clear: conditions have rarely been "normal," as we will show you in three examples.

1. Fishery harvests are characteristically unstable, subject to irregular oscillations. This is illustrated in schematic representations of 150 years of Atlantic mackerel fishing, 50 years of American cod fishing and 37 years of Pacific sardine fishing.

2. A graphic record of 20 years of sardine fishing in northern Spain shows very uneven results.

3. In 300 years of Japanese fishing for tunny, skipjack, herring, squid, and saury, periods of abundance alternate with periods of scarcity. Data are not statistically good enough to demonstrate any periodicity in these waves; nevertheless some Japanese scientists interpret that waves of maximal abundance have occurred about as follows: tunny 60 years apart, skipjack 80 years apart, sardine 100 years apart, and Hokkaido herring 50 years apart.

Part of the fluctuations shown in these records reflects economic conditions, part reflects the degree of accessibility of the fish on fishing grounds, and part—surely a very important part — reflects fluctuating abundance of the fish. Fishery biologists work continually to resolve these influences and have made much progress in that effort. They have long been in general agreement that fluctuations in environmental conditions cause fluctuations in abundance of the fish; but what elements of the environment are critical and by what mechanisms they affect the survival of fish, are problems that remain largely unsolved. As long as that is true, fishing must continue to be the uncertain occupation that it is.

Agricultural science is far ahead of fishery science in understanding the biology of the environment and making use of that understanding. But then, of course, the problems of agriculture, difficult though they may be, are very much simpler than those of fisheries. For the farmer has the enormous advantage over the fisherman of being able to perceive his produce as it develops; and there are various things he can do to protect it when a period of unfavorable weather hits, such as a cold spell or drought. Because the farmer can follow the vicissitudes of his product with his eyes, he is constantly aware of what is happening on his land. He knows the limits of his piece of the

vironment and he can put a fence ound it which will contain his crops d his animals; and therein they ll stay until he is ready to harvest em.

The fishery man enjoys none of ese advantages. The environment which he is most interested, the dy of water in which dwell the hery stocks that give him his living, continually moving, changing direcn, position, levels. Now it is close the shore, now far at sea, now the surface, now deep in the depths. expands and contracts, like a living ing; and as far as we can tell, the shery stocks which it contains tend ways to fill it to its capacity and to main in it wherever it goes. But capacity evidently also changes nstantly. All the evidence which s accumulated about the natural story of aquatic animals indicates at their environments have limits eyond which they cannot stray very r. How can we define those limits? ow can we distinguish a body of ater which contains all the mateals that attract mackerel from a ody of water which repels them?

emperature and Environment

One of the most obvious boundars of the territory in which an quatic animal can live is tempera ire. Fish are exceedingly sensitive temperature. I will give you one xample to illustrate this point.

Dr. H. O. Bull, a marine biologist orking at the Dove Marine Laboraory, Cullercoats, England, became nterested in learning just how sensive a fish is to various qualities of he environment. What does a fish eel? That was the sort of question e asked, a very difficult question ecause fish feel and respond to many different stimuli. So it was ecesssary to build special aquaria esigned to permit him to exclude all timuli except the one being studied. o he carried on a number of experiments to test the sensitivity of cod ish to temperature. First he condiioned the fish to associate the presnce of food with a change of temerature. Then, having done that, he etermined what degree of change the ish would respond to by observing he minimal temperature at which it would perform a complex task in rder to get food. He kept the fish in specially constructed tank with the loor inclined so that one end was eep enough to provide a habitable iving space and the other end exended out of the water. He introluced the food into a chamber at the upper end of the inclined floor. Gradually, over the many days that the conditioning process went on, the fish learned that food was in the chamber when the temperature of the water increased. As this association became more and more firmly established, the subject fish became conditioned to move up the inclined plane. At the same time, the food chamber was gradually moved upward, day by day, even farther out of the water. At last the fish learned to go quite out of the water, wriggle into the food chamber, and there wait practically high and dry until food was given, which it then seized sharply, and swam and splashed back to its normal position in the deep part of the tank. There was no mistaking the response. If the fish detected a change of temperature, it went through this remarkable performance; otherwise it did not.

With such experiments, Bull demonstrated that under some circumstances, sea fishes react purposefully to changes in temperature of only 0.03° C., and in salinity of 0.2 parts per thousand. These results indicate the extreme care with which field oceanographic studies must be designed, and the precision with which observations must be made at sea—the figures are close to the limits of accuracy of hydrographic instruments—in order to determine relations between oceanographic conditions and biological effects. They also suggest how some striking changes in marine climate that have been observed in recent years can affect the fish directly. The distribution of marine animals is sharply limited by temperature barriers.

A chart showing the distribution of sardines of the world indicates that sardines are somewhat less closely bound to land masses than are other members of the same family with which we are familiar, namely herring, menhaden and shad. Shad must ascend rivers to spawn; menhaden spawn about estuaries; herring in the intertidal areas; sardines may spawn as far as 200 to 300 miles at sea. Their young come close in, the first

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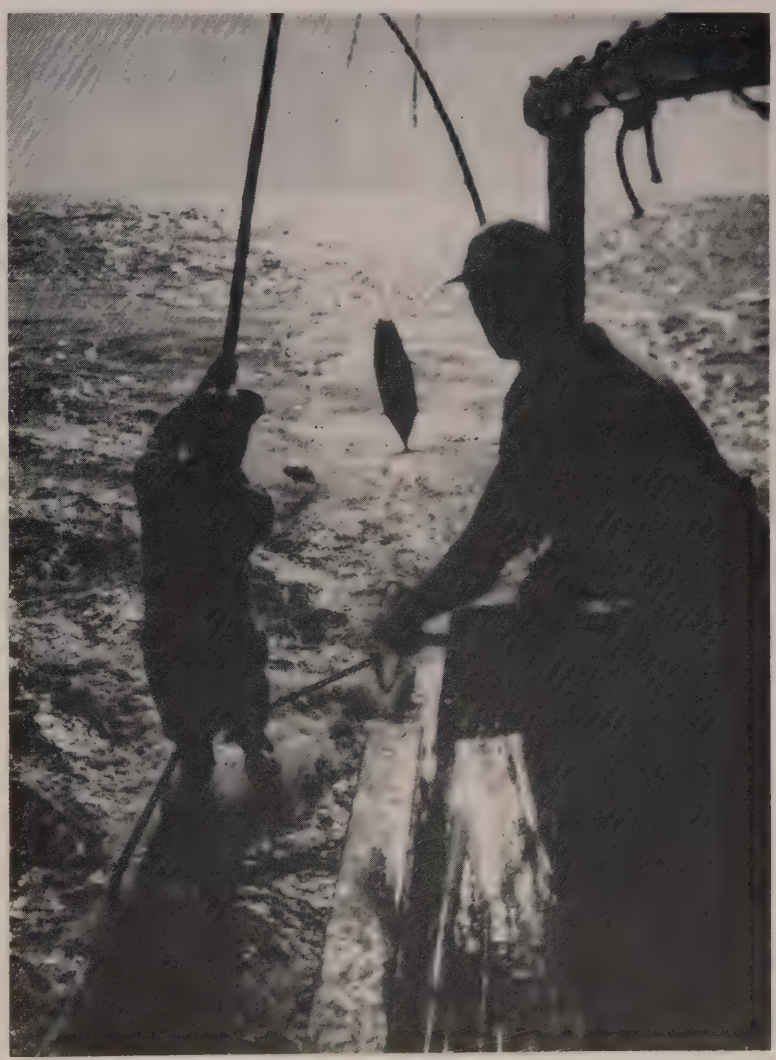

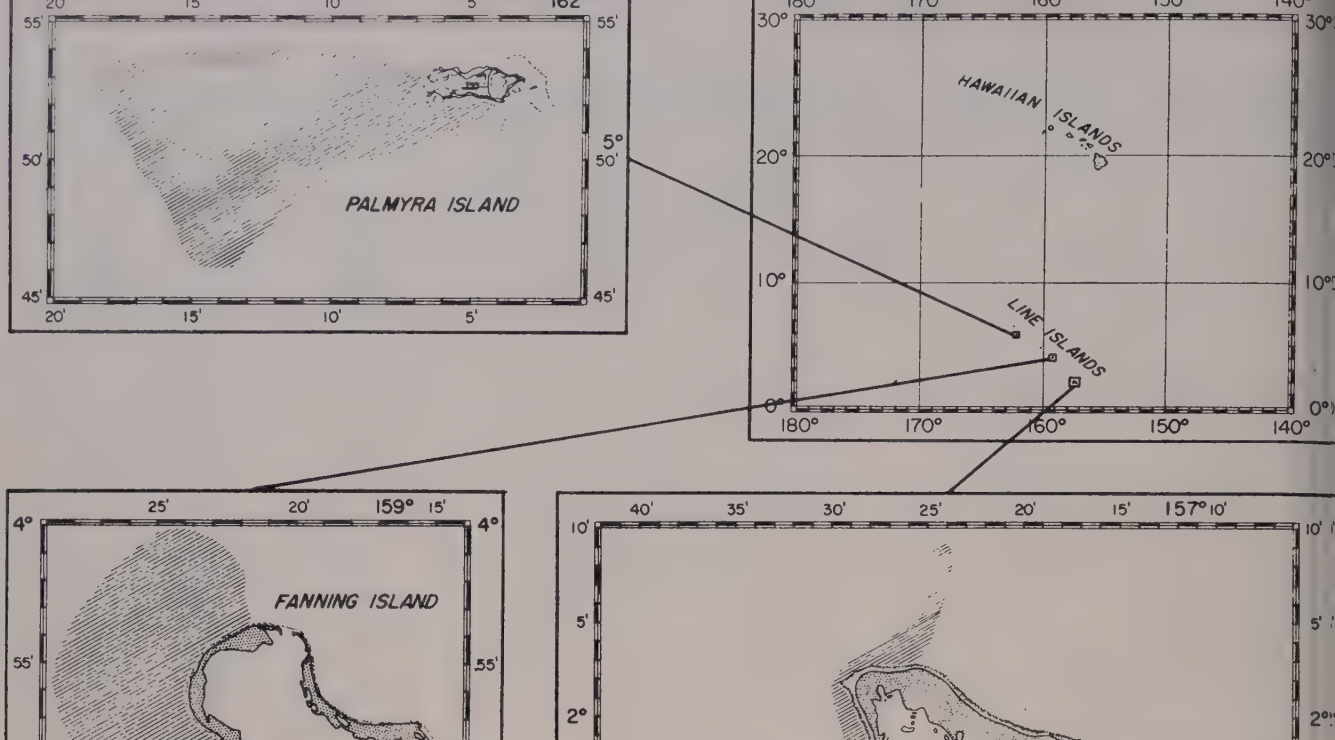

TROLLING

Around the Central Pacific Islands . . .

FISHERY research vessels of the U.S. Fish and Wildlife Service based in Hawaii have during the past few years done a considerable amount of trolling around the Hawaiian, Line, and Phoenix islands and on the open sea between these central Pacific island groups.

Some of this fishing has been done deliberately to test the commercial trolling possibilities close to the shores of the islands, but the greater part of it has been done routinely on the runs incidental to longlining, purse-seining, and oceanographic work.

A new publication of the Pacific Oceanic Fishery Investigations, "A Summary of Sightings of Fish Schools and Bird Flocks and of Trolling in the Central Pacific" by fishery biologists Garth I. Murphy and Isaac I. Ikehara, brings together and analyzes the results of a good deal of this trolling as well as the observations of surface signs of tuna that are recorded by wheel watches on all runs of POFI vessels.

The report covers 546 days' observations, with the results divided up to compare "island," semi-oceanic," and "oceanic" areas, depending on the distance from land. It was found that surface schools of tuna were sighted at about the same average rate from the inshore waters out to about 180 miles from land, but that there were considerably fewer sightings in the open ocean beyond that distance. The trolling catches showed a relatively high abundance of tunas within 60 miles of the islands, with uniformly low catch rates farther out.

Seasonal patterns were about the same for the three island groups scouted, with surface signs of fish appearing most frequently from June to November, however, there was some difference in the kind of tuna encountered, skipjack being the most abundant species around the Hawaiian Islands and yellowfin dominatin in Line and Phoenix islands waters. Everywhere beyond 60 miles from shore skipjack were the predominant tuna.

POFI vessels found their best trolling in the inshore waters of the Phoenix Islands, with an average catch of 43 tuna, all yellowfin, per 100 line hours. The average for the Line Islands was lower, 27.6 fish, again nearly all yellowfin ranging in weight from 13 to 69 pounds. This is contrasted with an average of only 0 tuna per 100 line-hours from the fishing done more than 60 miles from land.

Possibly of great significance was the discovery of large numbers of surface schools of skipjack in portions of the open equatorial Pacific far from land. In these areas schools were sighted almost as frequently as in the Hawaiian Islands area where there is a commercial fishery. According to Dr. A. L. Tester, director of Pacific Oceanic Fishery Investi

ions, it should be possible to pre-ely define these open ocean re-urces with the special sonic gear be installed on the *Charles H. Gil-rt* early this coming winter.

Other facets of POFI's tuna re-urch effort in the central Pacific e represented in three other Special ientific Reports recently issued by that agency. One reports the results of biologist Heeny Yuen's work on the spawning of the bigeye tuna, another is oceanographer James McGary's study of the movements of water masses around the main Hawaiian Islands, and the third, by fishery biologist Richard Shomura, compares and evaluates the performance of different longline baits. *

Report In Three Categories . . .

Bird Flocks and Fish Schools

THE RESULTS of 546 days of troll-g and watching for bird flocks and sh schools are summarized in three tegories based on distance from lands . . . in Fisheries Report No. 54 of the Fish and Wildlife Service.

According to researchers Garth I. urphy and Isaac I. Ikehara, the equency of fish school sightings pears to be a function of the abund-nce of birds, and was lower beyond 30 miles from land than within that nge. Skipjack were the dominant ecies in the open ocean; yellowfin ere more abundant near land in ost instances. There is a seasonal attern in the frequency of sightings, ossibly associated with the life pat-rns of the birds.

In island areas good agreement as obtained between the abundance f fish schools and the abundance of lankton. In the oceanic areas the greement was not very good.

The sightings and trolling catches uggest several generalizations on the istribution of surface tunas in the entral Pacific. First, close to the eefs there appear to be concentra-ions of tunas dominated by the yel-owfin. Beyond the immediate vicin-ty of the reefs the presence of land oes not seem to affect the abundance f tuna but does affect the species omposition.

Yellowfin schools are sighted more requently in the island than in the emioceanic and oceanic zones, where kipjack dominate. This may indicate hat the presence of land alters the cology in such a way that yellowfin an exist in larger numbers in the djacent waters. Skipjack, on the ther hand, dominate the semioceanic nd oceanic zones, being almost com-letely replaced by yellowfin in the island zones of the Line and Phoenix islands, and to a limited degree of the Hawaiian Islands.

Since it appears that the mere presence of land does not alter the density of the tuna population, except in limited areas, we should consider the possibility that the different levels of abundance (disregarding species) in different island and oceanic areas are a function of different levels of general productivity of the oceanic waters. To examine this hypothesis, it is necessary to suppress variation in the tuna population associated with different seasons, either by comparing different areas in the same season or by making comparisons between areas having representation throughout the year.

The latter course appears the sounder, because we do not have the information on homologous seasons, and if comparisons are limited to segments of the year there is danger of comparing one area at its peak with another area at an "off season." Finally, comparisons must be restricted to areas or zones equally accessible to aquatic birds, because most schools are overlooked unless working birds advertise their presence.

Comparing Fish Schools

In order to compare the relative abundance of fish schools with productivity we shall use the standing crop of zooplankton, the level of which has been shown to be related to the oceanic circulation as an index of relative oceanic productivity. Considering the three island areas, data indicates that the relative order of island groups with respect to zooplankton abundance is Hawaiian Islands, Phoenix Islands and Line Islands in ascending order. If these same groups of islands are listed according to the apparent abundance of fish schools, using the average of the unweighted average quarterly sighting rates, their order remains unchanged. A similar comparison of fish-school abundance, using the semioceanic sightings, gives the same order.

In the oceanic area the abundance of surface fish and birds does not conform to the abundance of plankton as well as in the insular areas. North of 10° N. the abundance of zooplankton is relatively low as is also the abundance of birds and fish schools. The Countercurrent shows considerably more zooplankton than to the north, and here surface schools are also relatively abundant.

In the South Equatorial Current between the Equator and 5° N. latitude King reports even more zooplankton than in the Countercurrent, but fish schools are only about as abundant as in the zooplankton-poor region north of the Countercurrent.

South of the Equator (0° to 10° S.) there is somewhat less zooplankton than in the Countercurrent, but fish schools are slightly more abundant than in any of the zones under consideration, though there is reason to suspect that the sampling south of the Equator has not been adequate.

The discrepancies between fish schools and plankton in the oceanic area may not be in serious conflict with the general idea that the size of the population of animals (fish and birds) at one trophic level is related to the size of the population at lower levels (plankton), for we are here considering only one element of the fish population (surface schools that are mostly skipjack).

It was pointed out that the distribution of surface schools does not correspond with the distribution of subsurface or deep-swimming tunas (mostly yellowfin). The fact that deep-swimming yellowfin tuna are most abundant in regions of few surface tuna schools (0° to 5° N. lat.) suggests that if it were possible to consider quantitatively the higher vertebrate fauna as a whole, there might be better agreement in the horizontal distribution of the groups of organisms at different trophic levels.

However, the question still remains: Why does the zone with low numbers of surface skipjack schools coincide with the zone of high numbers of deep-swimming yellowfin

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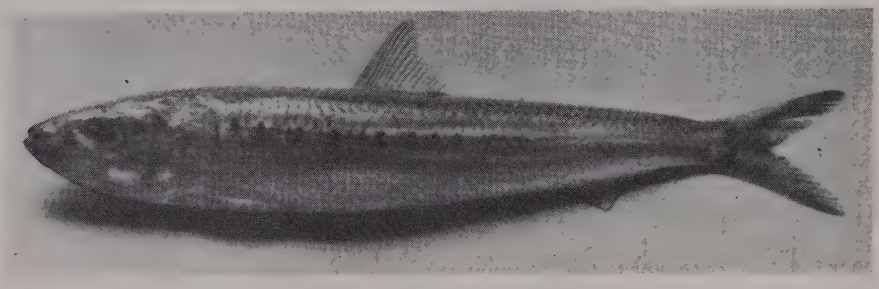
HISTORY OF THE ESTABLISHMENT OF MARINE RESEARCH COMMITTEE AN THE CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATION



ALL ABOUT CALIFORNIA'S *Elusive Sardines*

By HERBERT C. DAVIS

In the middle 1940's, the California sardine commenced to disappear; first from British Columbia, then Oregon and Washington; and finally, during the 1945-46 season, San Francisco produced only about one-third of a normal catch and Monterey about one-half. Southern California had not yet noticed any decline in its fishery.

At this point the industry took particular cognizance of the great diversity of opinion extant pertaining to the causes of this decline. Some said it was due to overfishing. Others contended it was due to oceanic changes. Still others contended that we had failed in our research. There was generally no agreement as to what had happened and what should be done about it.

The California sardine industry promptly proposed to the legislature an increase in the tax on sardines and the establishment of a committee to supervise the expenditure of this fund for expanded research in an attempt to get the answers.

The 1947 session of the legislature created the Marine Research Committee composed of representatives of the industry, the Division of Fish and Game, and the public. This committee was to supervise the expenditure of funds derived from a 50c per ton tax on sardines, which was also provided by the 1947 legislature.

The tax was increased to $1.00 at a later session, again at the behest of the industry, and was assessed against sardines, mackerel, anchovies, and squid. The 1955 session of the legislature has reorganized the Marine Research Committee by removing the representatives of the Department of Fish and Game and substituting a representative of the sportsmen, labor, and an additional public member.

To carry out its work, the committee contracted with various agencies to do certain work, and as a result, there came into being the California Cooperative Sardine Research Program in which the four following agencies participated and received grants of money from the committee:

California Academy of Sciences,

California Division of Fish and Game,

Scripps Institution of Oceanography, and

U. S. Fish and Wildlife Service.

Later, the Hopkins Marine Station of Stanford University was added as a cooperator and the name of the program was changed to the California Cooperative Oceanic Fisheries Investigation because it was found advisable to include research on mackerel, anchovies, and other fishes in order to find answers to some of the questions relating to sardines.

Each of the cooperating agencies was assigned certain specific work, and their collective efforts were d signed to find the answers to the fo lowing questions:

(1) What causes fluctuations fish populations?

(2) What is the contribution man to these fluctuations by his u lization?

(3) What can man do to contr or regulate these fluctuations?

These investigations are now their eighth year, and so far, t results have been quite satisfacto but far from complete or conclusiv There has been considerable disagre ment among certain of the coopera ing agencies in the matter of inte pretation and conclusions of the r sults so far obtained. From the poi of view of the non-participating o server, the results so far appear to about as follows:

(1) Nature, with her vagaries the field of oceanography, throu changes of currents, temperatur salinities, and other factors, plays far greater roll in the fluctuation fish populations than was previous understood.

(2) The apparently well-plann overall program necessitated the e penditure of much time, effort, a ingenuity in developing techniques carry out many of the assignmen This work consumes time, but do not produce measurable results answering immediately the speci questions.

(3) The magnitude of the proble is demonstrated to extend far beyo the coastal limits of California.

Mr. Davis is Assistant Executive Director, California Fish Canners Association, Inc.; and formerly was Executive Officer, California Division of Fish and Game.

4) No concrete or specific pro-
als have yet been agreed upon, in
field of management, predicated
n the findings to date.

We referred above to the divergent
nions relating to the causes of the
ctuations in the abundance of sar-
es prior to the establishment of
Marine Research Committee. Dur-
the 1930's the staff of the Divi-
n of Fish and Game advocated
ntitative limitations on fishing so
t a trial and error procedure
ld be set up to determine the effec-
ness of this procedure in estab-
ing a maximum limit for fishing
ich would preserve the fishery.

This approach was advocated on
assumption that *man's* exploita-
n was the *only* factor influencing
pulation declines. The industry dis-
eed with this trial and error pro-
lure on the grounds that there was
evidence that *man's* activity was
sole cause of fluctuations or even
ignificant contributor.

This lack of evidence of the prob-
e result in conserving the resource
the industry to also contend that
business involving capital invest-
nts and the employment of sub-
ntial segments of labor and con-
buting to the economy of the state
uld not be used as a guinea pig
test a theory that controlled fishing
ght control the abundance of the
pulation.

The industry and the sportsmen
ntly employed Professors Rich and
eymouth of Stanford University to
aluate the research done to date by
Bureau of Marine Fisheries and
report on whether the research
uld support the contention that
antitative limitations were needed
r sound management.

Professors Rich and Weymouth
esented their report in August of
36 under the title, "A Review of
e Evidence of Depletion of the Cali-
rnia Sardine." Their conclusions
re:

"Although there are some indica-
ns of reduced abundance, we find
at the changes that have taken place
the methods of the fishery have so
fected the observations that only
e data for the past seven years can
used for analysis. This is not a
fficient period of time in which to
velop definite and conclusive evi-
nce of depletion in such an enor-
ous and widely-distributed fishery
r a pelagic species as the Califor-
a sardine, and we have been forced
conclude that none of the criteria
presented by the Division of Fish and Game gives positive evidence of depletion . . . Stabilization of the fishery at some fixed, arbitrary level, careful observation over a period of years, and ultimate adjustments of this level to the biological requirements will provide adequately for conservation and at the same time permit the maximum use of the resource."

In the spring of 1948 after the creation of the Marine Research Committee, the industry once again participated on a General Advisory Committee authorized by the Fish and Game Commission. Labor was dissatisfied with the research and conclusions of the Bureau of Marine Fisheries and proceeded to review the research with their own facilities. It is significant that the findings in the so-called "Pinsky Report" prepared by the Research Department of CIO and the conclusions of the Advisory Committee of the Fish and Game Commission are the same, to wit:

"There is no conclusive evidence that the present sardine scarcity is due to overfishing. It is evident that unknown factors in oceanographic conditions may be primarily responsible for the present decline of the sardine fishery. The commercial exploitation of the fishery cannot be considered as a major cause of the present failure of the fishery."

Professor Willis H. Rich of Stanford University was asked in March, 1948, to re-examine the situation and bring the 1936 report up to date. He reported as follows:

"In the writer's opinion, the present situation has arisen almost entirely from natural causes; but, at the same time, the level of abundance is now so low that the intense fishery may well be a factor in delaying recovery. The evidence of both the Division of Fish and Game and of the Fish and Wildlife Service is to the effect that there has been poor recruitment in every year from about 1940 or 1941 to 1945. Yet there was no apparent reduction in abundance of spawning fish during those years; the catches remained at about the 500,000 ton level. It seems, therefore, that most, if not all, of the reduction in abundance that has occurred since 1945 was primarily the result of natural conditions that affected adversely the survival of the eggs and young fish. The poor recruitment rate has now prevailed for so long a period that abundance has been seriously affected."

Prof. Rich went on to state that while he and Dr. Weymouth had advocated a bag limit for experimental purposes back in 1936, it is now obvious that if the limitations advocated by the Diviison of Fish and Game commencing in 1929 of 200,000 to 250,000 tons had been imposed, and "had catch limits been imposed at the levels recommended, serious economic loss would have

(Continued on page 18)

A TYPICAL PURSE SEINE BOAT

Bird Flocks and Fish Schools

(Continued from page 13)

tuna? Sampling is, of course, always suspect, particularly in this instance, when the critical region (0° to 5°) is represented by only 16 days, though these were well distributed in time and space.

The possibility of competition with other species was inferred above. An alternative hypothesis is that the vertical distribution of food organisms in the region of low surface sightings differs in such a way that the fish do not spend as large a fraction of their fife at the surface as they do in the adjacent areas to the north. Or, even if differences in the vertical distribution of food organisms do not affect fish, the differences might affect the density of aquatic birds, thus altering the apparent abundance of surface schools of fish.

Summary of Findings

1. During the period October 17, 1950, to April 4, 1953, there were 546 days during which surface trolling and bird and fish watches were maintained on POFI vessels in the central Pacific. These observations have been separated into "island" (0 to 60 miles from land), "semioceanic" (60 to 180 miles from land), and "oceanic" (more than 180 miles from land) provinces.

2. The seasonal pattern of frequency of daily sightings in the Hawaiian Islands area closely resembles the seasonal pattern of landings of the commercial tuna fishery. The frequency of fish sightings appears to be a function of the abundance of birds.

3. The seasonal patterns in the Hawaiian, Line, and Phoenix islands are similar, with greater frequency of sightings during the period June to November.

4. Skipjack dominate the surface schools in the Hawaiian area, and yellowfin dominate in the Line and Phoenix islands.

5. The frequency of sightings in semioceanic areas is approximately the same as in the island areas.

6. The frequency of sightings in the oceanic areas in general was lower than in island and semioceanic areas.

7. Skipjack are evidently the dominant surface tuna in the oceanic and semioceanic areas, and surface yellowfin, if not dominant, at least are relatively more abundant close to land.

8. There is an indication of seasonality in the abundance of surface schools in the oceanic area, probably differing from the seasonal pattern in island and semioceanic areas.

9. Trolling indicated a relatively high abundance of tunas, particularly yellowfin, in the near proximity of islands, with a uniformly low abundance in the semioceanic and oceanic areas.

10. The evidence indicates that the abundance of surface schools near islands in the central Pacific is a function of the standing crop of plankton. In the oceanic area the abundance of surface schools and birds does not closely parallel the abundance of plankton. *

Exploratory Cruise for Salmon

Salmon were caught at every station fished by the FWS exploratory vessel *John N. Cobb* in the offshore waters of the Gulf of Alaska and adjacent areas of the North Pacific. A total of 50 gill-net sets showed that salmon were widely distributed on the high seas from off northern Vancouver Island to Dutch Harbor, Alaska, during the 12-week cruise from June 23 to September 18, 1955.

Results of the exploratory fishing yielded valuable new information on the offshore distribution, abundance and availability of salmon to certain types of gear. All fishing was carried out from 50 to 300 miles offshore, and a few stations were fished a second time after an interval of about two months to compare catch results at different times. All five species of Pacific salmon were caught in a number of the gill-net sets, other sets produced from one to four species. Chums were most abundant in the over-all catch, with kings least numerous.

The majority of the salmon were of good size, apparently from this year's spawning stock. Smaller fish representing later year classes were taken in the smaller mesh nets designed to sample immature salmon feeding in the area.

Total gill-net catch for the 50 sets was 2,484 salmon, an average of 4 salmon per set: 1,248 chums, 63 pinks, 367 reds, 211 silvers, and 1 kings. Individual catches ranged from 1 to 168 salmon. The gill nets also caught 55 steelhead trout and various numbers of pomfret, scad, mackerel shark, and a few ragfish. Salmon trolling gear fished for 28 hours in the vicinity of 5 gill-net stations caught 22 fish—18 silvers, 3 pinks and 1 king.

Exploratory Cruise for Shrimp

Shrimp exploration off the coast of Washington will be the primary objective of a four-week cruise by the FWS exploratory vessel *John N. Cobb* leaving Seattle on October 1. A limited amount of deep-water exploratory trawling for bottom fish to record seasonal abundance in certain areas will also be carried out as time and weather permit.

This project will be conducted by FWS in cooperation with the Washington State Department of Fisheries. There has been considerable industry interest in potential shrimp grounds off the Washington coast in recent years. Successful exploration by the State of California in 195 and 1951 resulted in the establishment of a commercial shrimp fishery off northern California. The State of Oregon also carried out encouraging shrimp explorations off the Oregon coast in 1951 and 1952.

To determine species of shrimp present and whether they can be caught in quantities and sizes which could support commercial fishing, the *Cobb* will make a series of exploratory drags on the continental shelf out to 100 fathoms with main fishing effort centered off Grays Harbor. A 20-foot shrimp beam trawl and a small-mesh otter trawl will be used to obtain a full picture of bottom life in the area. Surface and sub-surface water temperatures and bottom samples will be taken at each fishing station.

The GLOBE

An International News File Compiled from FOREIGN REPORTS

Argentine.—The Japanese Fishery Agency's new project is a fishery survey of the Argentine coast. The research ship Toko Maru (1,098 tons), which recently returned from patrol duty in the North Pacific and Bering Sea, expects to sail from Tokyo around November 5 and circumnavigate the globe, taking about nine months for the cruise.

After leaving Tokyo, the ship will put in at Singapore and Colombo, cross the Indian Ocean, investigate fishing grounds south of Madagascar, put in at Capetown, and then cross the Atlantic to Buenos Aires, where it will arrive in January. After conferring with Argentine authorities, the party will proceed to Ushuaia in Tierra del Fuego, which port will be the base for bottomfish investigations. On the way back up the coast other types of fishing will also be tried. The Toko Maru will return to Buenos Aires around May 15 and sail for home on May 20, 1956. Depending on next year's budget, calls may be made at Rio de Janeiro and in Venezuela, and if time permits, fishing grounds off other South and Central American countries may be investigated. The ship will put in at Hawaii on its return voyage.

The following types of fishing will be tried: bottom fishing with trawls, shrimp nets, and crab tangle nets; surface and mid-water fishing with lift nets, pole and line, and tuna long lines. The main area to be investigated will be the continental shelf off Argentina south of 35° S. latitude.

Australia.—The Eden tuna cannery has extended its facilities, installing a 40x20x3 foot refrigerated brine tank to hold fish at 28° F. Fish will be discharged from the boats into this tank for holding until they can be frozen and glazed. The freezer can handle 20 metric tons at —30° F. in a 24-hour turnover. As the cannery can handle 10 tons of fish in an 8-hour shift, two shifts would keep up with the capacity of the freezer. The cold-storage capacity at a temperature of —5° F. at the Eden cannery is also being increased to 500 metric tons. Including the 200-ton cold-storage capacity available at the Narooma cannery, a total cold-storage capacity of 700 tons is available for holding fish for canning.

Greenland.—A total of 19 large West German otter trawlers made trips to the Greenland cod banks this past summer and returned with good catches, according to a Danish fishery trade paper. In addition to cod, the trawlers caught large quantities of ocean perch on the outer edge of the banks. The total catch for 17 of the trawlers amounted to 9.8 million pounds.

Guatemala.—The Ministry of Agriculture reports that it approved several months ago, an American businessman's application for permission to employ two Mexican fishing vessels to explore the banks off the Pacific Coast of Guatemala. The Ministry believes there may be sizable shrimp beds although it does not have supporting data to indicate the location or size. If the problems of refrigeration and transportation could be solved, a considerable domestic market could probably be developed for seafood products.

Japan.—The Japanese fishing company (Nippon Reizo Co.) operating off American Samoa with the mothership "Saipan Maru," completed in September its first three months under a six-month contract to the tuna cannery located in that Island. During the first half of the scheduled operation there was difficulty in locating the fishing grounds because of unfamiliarity with the waters, and the catch of 2,895 metric tons was less than planned. However, the fishermen at last learned the grounds and the catch picked up to about 3.25 tons per day, thus fulfilling the program in the latter half of the operation.

Japan.—The Japanese salmon mothership "Koyo Maru" has been making preparations to operate as a tuna mothership in southern Pacific waters during the off-season in the northern salmon fishery. After receipt of Japanese Fishery Agency authorization, the ship sailed from Tokyo on September 12 and headed for the Fiji area, where the mothership "Tenyo Maru" is operating at present. The production goal is 5,356 tons, and the fleet will comprise about 50 vessels.

Peru.—The fish export market continues to be weak because of the lower quotations for frozen tuna at United States canneries, but expanding European markets for Peruvian canned fish are providing some relief. Experiments in canning trout from the mountain lakes which teem with fish, especially Titicaca, are giving good results; but it remains to be seen whether a commercial cannery is feasible, according to a dispatch from the U.S. Embassy at Lima.

Portugal.—A group of 30 south Portuguese canners and exporters of sardines and other canned fish met under the auspices of the U.S. Chamber of Commerce in Portugal to consider measures for the promotion of their products in the United States. They are considering the appointment of joint representatives in distribution centers other than New York, notably Chicago, New Orleans, and San Francisco. They are considering the possibilities of marketing their products under a joint trade name. Two representatives of the group are being sent to the United States on an investigative and promotional tour.

California's Elusive Sardines

(Continued from page 15)

resulted and, except possibly for the last few years, there would have been no compensation in the way of improvement of stock. In the same year (1939) that the Division of Fish and Game recommended reduction of the catch to 250,000 tons, breeding was unusually successful and the brood of that year dominated the fishery for several years." . . . "The drastic limitation of catch that was proposed in 1929, or even in 1939, was certainly not warranted, as is clear from the later developments."

J. L. Hart, Fisheries Research Board of Canada, wrote in 1948, "Pilchard production has declined markedly for the fourth consecutive year in Canada and the third on the whole Pacific Coast . . . There can be little reasonable doubt that the principal cause of the failure lies in the unsuccessful reproduction, which has led to the decline of the pilchard population in the northeast Pacific. The cause of this failure to reproduce successfully is the major uncertainty. It may be that the intense fishing along the Pacific Coast of North America has reduced the spawning population of pilchards to the point where the chances of successful reproduction are gravely reduced. Relative failures in reproduction have, however, occurred in other years when spawning was presumably adequate."

This was the status of the record in 1948—the Division of Fish and Game claiming depletion and advocating quantitative limitations as a cure—others questioned the evidence of depletion and questioned the validity of quantitative limitations for any purpose other than experimental.

The Marine Research Committee undertook to contract for research to clear the atmosphere and attempt to resolve some of the differences. After eight years of work, much progress has been made but, unfortunately, the same fundamental differences of opinion still prevail as shown by the following:

In January of 1954, Mr. Richard Croker, Department of Fish and Game, wrote in "Outdoor California" an article entitled, "The Sardine Story—A Tragedy—Loss of California's Sardine Fishery May Become Permanent." In this article the author asks and answers three questions, and adds a few conclusions.

(1) What has caused this catastrophe?

(2) Could it have been prevented?

(3) Will the sardines return, and can we help them?

"The answers to these questions are complex, but we have them."

Answer (1) "The causes of scarcity can be summarized as too much fishing and not enough reproduction."

Answer (2) "The sad part of this story of a failing industry is that it could have been prevented."

Answer (3) "Now scarcity has proceeded so far that even if oceanic conditions should become favorable we fear that insufficient spawning sardines remain to take advantage of them to produce a good catch."

Thus we see that the contention of depletion, and the claim that quantitative limitations would have changed the picture, still persist as the theme of the staff of the Department of Fish and Game after all of these years.

At about the same time, and apparently based on the same facts, the other agencies engaged in the cooperative research offer the following divergent opinions:

"The Sardine Situation July 1, 1953"—Progress Report—California Cooperative Oceanic Fisheries Investigations July 1, 1952-July 1, 1953.

"(1) The bulk of the sardine population today is concentrated in the waters off Baja California, where it is largely unavailable to sardine fishermen of the United States.

"(2) There are fewer sardines in California waters than ever before.

"(3) There is little reason to hope that sardine fishing in the next two years will reach the level attained in the years of prosperity.

"(4) The most numerous year class present is that spawned in 1952, and evidence points to its being smaller than the 1948 year class.

"(5) Anchovy and jack mackerel populations appear to be satisfactorily abundant. Pacific mackerel catches, on the other hand, point toward a low abundance of these fish throughout California waters.

"(6) The research studies on which these conclusions are based are outlined in this report. We are able to give some clues as to the causes of the catastrophic decline in sardine landings, but are not able to isolate any single primary reason. As the studies progress, it begins to seem more and more probable that it is a combination of several factors that has brought the sardine catch to its low level and until we can identify and measure each of the most important factors, no complete explanation can be given for this or a similar crises which may overtake any of our marine fisheries."

There has been no published report from these cooperative investigations since. However, in the summer of 1955 the cooperating agencies did report and exchange information at a four-day session held at Julian, California. The conclusions were reported to the Marine Research Committee at a meeting held in San Pedro on July 15.

There is a fair agreement that the stocks were in the order of 4 to 4 billion fish in the 1930's, 2 to 25 billion in the 1940's, and 1 to 15 billion in the first half of the 1950's with an average minimal population of about 6 billion fish.

The conclusions were that after studying all of the available material there was still disagreement among the cooperating agencies on the two fundamental questions; (1) What effect has the catch of man had on the total population, and (2) Is the present stock of possibly 6 billion fish sufficient to re-establish the stock at its former level if environmental conditions were satisfactory.

The printed report for the period July 1, 1953, to March 31, 1955, is expected to be available shortly.

These continuing divergencies in opinion on fundamental problems make it difficult, if not impossible, for the industry and the legislature to presently take any positive step in any direction toward changing methods of management because they could just as easily be wrong as right.

l Sardine Season
irts Well

irst two days of the current sar-
e season saw a total catch of
0 tons brought into the canner-
at San Pedro, Terminal Island
Long Beach.

ome 60 purse seine boats were
ked up at Fish Harbor on Termi-
Island as they waited to unload.
otal of about 125 fishing boats
out to sea Monday night, Novem-
7, for the first time this season
following a five-week delay
asioned by a dispute over prices.

nvolved in this dispute were the
ners, boat owners, and two unions
he Seine and Line Fishermen's
ion, AFL, and the International
hermen's Union.

he 8,000 ton mark reached in the
t two days fishing is approxi-
tely one-fourth of the 30,000 ton
regate quota of sardines to be
ivered to the canneries during the
t 20 days of the season under
ns of the price agreement.

After the first few days the fishing
ults were tapering off, so the final
come is still anybody's guess.

The Salmon Catch

Braced by a resurgence of catches in the third week of September, the Puget Sound pink salmon season closed with a catch of 5,250,000 fish, slightly above average for the 20-year period 1935-54, the Department of Fisheries reported recently.

The pink salmon case pack was the equivalent of 387,434 48 pound cases with a wholesale value of $8,-861,000. Of that total, approximately $5,000,000 represents the earnings of fishermen.

In numbers, the pink run compared with 6,000,000 fish in the parent year 1953 and 5,600,000 in 1951. The 20-year average is 5,120,000. The 1953 pack was 443,000 cases.

The canned total included 260,995 cases of one-pound talls and 191,288 ½-pound cases. Cases of four-pound tins totaled 29,054.

The combined American-Canadian pink salmon catch from stocks fished upon in common by both countries is estimated to be at least 9,250,000, compared with a joint take of 10,-000,000 fish two years ago and 8,500,000 in 1951. The figures reaffirm the stability of production which has marked the fishery since 1947.

The sockeye salmon catch edged over 1,000,000 fish with a total of 2,100,000 for the two countries. This is the best output for the "off year" Fraser River cycle since 1903 with exception of the parent year 1951, when the catch was 2,400,000.

Net catches of silver salmon on Puget Sound and offshore troll landings to date amount to about 1,000,-000 fish. This is below the parent year 1952, but about average for the base period 1953-54.

One of the largest fleets in history participated in the pink salmon fishery. By the end of September the Department had issued 370 purse seine, 800 gill net, and 110 reef net licenses. The total for 1954 was 310, 631, and 102.

Because of increased gear intensity, the American fleet was limited to a five-day fishing fleet throughout the pink season for the first time in history. Traditionally the weekly closed periods have allowed six-day fishing in most areas during the pink run.

Commercial fishing throughout Washington state will continue until November 30.

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Public Hearing at San Pedro

TUNA PROBLEMS AIRED

A PUBLIC hearing on problems currently besetting the tuna industry was scheduled, it was stated, "in response to many requests received from West Coast citizens for an on-the-spot inquiry by the U.S. Senate Committee on Interstate and Foreign Commerce."

Senator Warren G. Magnuson, chairman of the Committee, was in charge of the hearing held in San Pedro. On November 3 he listened to a parade of nearly 30 witnesses, lasting from 10:00 a.m. until 7:00 p.m., most of whom reiterated in various forms the basic charge that the U.S. State Department has blocked all efforts by California's fishing industry to obtain protection from importation of low-priced Japanese tuna.

Hearings started on general fisheries problems in mid-October in Anchorage, Alaska, then shifted to Juneau, then south to Seattle and San Francisco, before resuming in Southern California, where the emphasis was on the tuna industry.

Facts gathered during the hearings will furnish the basis of legislation to be recommended for enactment during the second half of the 84th Congress which will reconvene in January.

About 500 fishermen and their wives, along with representatives of various phases of the industry, thronged the hearing hall in San Pedro. One of the witnesses was Ray Hamilton, a 32-year-old fisherman with a four-months' growth of whiskers who drew a chuckle by saying he had vowed not to shave until something is done about the tuna situation.

Mason Case, manager of the Fishermen's Co-operative Association, stated that "the California fishing fleet needs the immediate protection of a quota system or tariff on both canned, fresh and frozen fish, and perhaps help in the form of government subsidies."

Speaking as the representative of nearly 200 tuna boat owners, Case added: "The State Department has blocked every appeal we have made to government officials." He said that he had attended a hearing in Washington last June and got nowhere. State Assemblyman Vincent Thomas of San Pedro, backing up these sentiments, said that Governor Knight is in full accord with the quota idea, with remedial action to come from the President, the State Department or the Congress.

Charles R. Carry, executive director of the California Fish Canners Association reported that "all but one cannery lost money last year." Financial papers some weeks ago showed that Van Camp's last statement was in the red for the first time in 25 years. Tremendous increases in the cost of labor and all other items connected with canning, transporting and selling have absorbed the difference between the cost of raw fish and its price in retail stores.

At the close of the meeting, Senator Magnuson said he was sympathetic to the troubles unfolded and hoped to recruit the support of all 11 Western States Senators. He appeared to favor legislation which would establish a quota on Japanese imports and a tariff of three cents a pound on frozen tuna . . . with some hope that Federal credit might be extended to fishermen in much the same manner as to farmers for the last several years.

Why Ships Collide?

Why do some ships still have co lisions, even though equipped wi radar?

The answer to this puzzling que tion interests mariners and all othe concerned with safety at sea. Mari insurance records continue to sho occasional mishaps between vesse despite one or both being equipp with the all-seeing eye of the mode radar system.

A recent study has determined th accidents involving radar-equipp ships fall into four major categori as follows: (1) radar not turned o (2) radar not properly adjusted; (improper action by operating pe sonnel; (4) "radar hypnosis."

Detailed information covering the causes has been collected and pr sented by Raytheon Manufacturi Company, major producer of mari radar equipment, in a 20-minute m tion picture film called, "Safe Pa sage."

Prints of the film for free sho ings to interested groups may obtained from Raytheon at Waltha Mass.

New Tide Tables

Tide Tables, Central and Weste Pacific Ocean and Indian Ocean the year 1956—has just been issu by the Coast and Geodetic Survey.

The new edition of tide tables c tains full daily predictions for reference stations and differences a ranges for about 2,500 stations. cluded in the publication is a ta for obtaining the height of the t at any time, and tables of astronom cal data giving times of sunrise a sunset, moon's phases ,etc.

The principal variations in the t from day to day and from place place are illustrated in the publi tion by charts showing tide curves 25 stations along the coasts of Jap and China.

Tide tables have been published the Coast and Geodetic Survey si 1853. The tables are issued in f volumes which include the en maritime world. Together they c tain daily predictions for 188 ref ence ports and differences and ran for about 5,000 stations.

This volume, named Serial 7 contains 370 pages. Copies of the t tables are distributed by the se agents, district offices, and the Wa ington office of the Coast and G detic Survey. Price 75 cents per co

ORT FROM WASHINGTON

(Continued from page 8)

ity for the fishing industry to benefit from this large potential mar- by developing eating habits that include fish.

School-lunch managers and cooks in several states will attend dem- trations and learn new and easy methods of preparing fish in the school chrooms. Children should therefore acquire an appetite for fish dishes, s increasing the use of fish both at school and in the home.

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AN OFFERS TECHNICAL AID.--The sixth session of the Indo-Pacific Fish- es Council, Food and Agriculture Organization, received an offer by an to give any interested country information on her technical skills h regard to fisheries. The offer is part of Japan's advocacy of inten- ied exchange of fisheries information and joint investigations and earch, according to the October 13 issue of Japan Report published by Japanese Embassy at Washington, D. C.

Forty delegates from 16 countries were to attend the two-week ting in Tokyo. One of the Council's objectives is the development and per utilization of the living aquatic resources of the Indo-Pacific as.

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ICE OF TERRITORIES APPOINTMENTS.--Appointment of Kirkley S. Coulter Deputy Director and of Carl L. Junge as Assistant Director for Alaskan airs, both in the Office of Territories, has been announced by Interior retary McKay. Both men returned recently from an extensive tour of ska which took them to many of the Territory's principal cities.

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RTUGAL'S CANNED FISH PLANS.--A group of Portuguese canners and export- s of sardines and other canned fish met under the auspices of the U.S. amber of Commerce in Portugal to consider measures for the promotion of eir sales in the United States. They are considering the appointment joint representatives in distribution centers other than New York, tably Chicago, New Orleans, and San Francisco, also the possibilities marketing their products under a joint trade name. Two representatives e being sent to the United States on an investigative and promotional ir.

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NTIAGO CONFERENCE SUSPENDED.--Representatives of the governments of ile, Ecuador, Peru and the United States, convened in Santiago, Chile r the purpose of discussing fishery resources of the Southeast Pacific d their conservation, suspended their negotiations on October 5 in a rdial atmosphere. The four nations issued a joint communique pointing the usefulness of the conversations in clarifying the points of view the four governments and the progress made in determining areas of reement. Suspension of negotiations was necessary since the stage had en reached requiring that the four delegations consult their respec- ve governments with the view to future renewal of efforts which would ad to an agreement on the conservation of fishery resources and fishing.

CANADA MAKES FISH PROGRAM PERMANENT.--With the inauguration of "National Fish Week" in Canada, on the same dates as those of the U.S., October 3 to 8, The Fisheries Council of Canada has announced that they will have a permanent promotion program to increase the consumption of fishery products in Canada. They will continue to participate in the N.F.I. Joint Public Relations Program to increase the consumption of fishery products in the U.S. and the Canadian fillet exporters will also participate in the U.S. "National Fish Week."

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SARDINE CONSUMPTION IN FEDERAL INSTITUTIONS.--Official reports show canned sardine consumption in 27 federal penal and correctional institutions. In 1954 these institutions had a combined average population of 21,175 persons and are located throughout the United States.

In 1954, almost 50% (13 out of 27), of the institutions surveyed did not use canned sardines. However, the non-users were the smaller institutions. Relatively few institutions in the South reported serving canned sardines while all the institutions in the Northwest and West served this product.

The average annual consumption of canned sardines for nine of the institutions reporting was 1.59 pounds per inmate. Of the institutions reporting was highest in Arizona, 3.67 pounds per inmate.

In the Pacific Coast institutions, the average price was $.17 per pound. In the other institutions the average cost was $.34 per pound.

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JAPANESE CANNED TUNA NOT DUMPED?--In an announcement dated October 5, 1955, the U.S. Treasury Department stated that an investigation showed that Japanese canned tuna exporters are not selling their products at prices below those charged in their own country.

The investigation was undertaken because of complaints by United States packers and producers of tuna that Japanese canned tuna was being "dumped" on the Amerian market at unfair low prices.

The Treasury in a memorandum to the press said the investigation showed that "such merchandise is not being, and is not likely to be, sold at less than fair value." This ruling by the Treasury prevents the matter from going to the U.S. Tariff Commission for consideration of injury to domestic industry under the provisions of the Anti-dumping act.

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U.S.-ECUADOR TRADE AGREEMENT.--Steps are being taken to change the termination date of the 1938 bilateral trade agreement with Ecuador from July 18, 1955, as had previously been announced, to January 18, 1956. This does not constitute a reversal of the decision to end the trade agreement, but is only a postponement.

This action will not change the present rate of import duty on canned sardines applied by Ecuador, which was established January 1, 1954, at 6 sucres per net kilogram. The trade agreement rate on canned sardines which was 0.49 sucres per legal kilogram under the 1938 agreement, has not been effective in recent years due to the imposition by Ecuador of exchange surcharges and increased rates of duty.

OFI ACTIVITIES

LD work was the prominent activity during September, with all POFI vessels at sea. The *Commonwealth* and the *Manning* continue the year's survey of tuna abundance in the Line Islands region, the phase of which will be complete ebruary 1956. During September work was highlighted by the ing of moderately abundant cs of deep-swimming tuna and a low population of small surface tuna.

he *Manning* completed the summer albacore survey. This survey was ducted simultaneously with *Nor*- and involved, in addition to the *ning*, the *Paolina T.*, a vessel rated by the California Department of Fish and Game. In addition he vessels specifically surveying acore, significant results were obed from the hydrographic cruise he *Hugh M. Smith* and from vesl of the North Pacific Salmon estigations gill netting for salmon.

uperimposing the results of all anizations reveals two populations albacore in the North Pacific separd by a wide gap apparently de- of albacore. One body of fish along the West Coast, with its thern boundary at about 44° N. its southern boundary off south- California, where it was support- the local albacore fishery. The thern portion of this concentra- seemed to lie about 300 miles oshore and was not being utilized the fishery. To the west of this ly of fish there was a gap to 157° , or due north of Hawaii. West of s point lay another mass of alba- e, as shown by the results of troll- and the results of gill net catches.

Studies of the local Hawaiian fish- continued, with major emphasis reorganizing the research program include the objective of explain- the fluctuations in the local ches. This latter study has already lded some promising leads, for the gnitude of the season's catch in waii appears to be intimately re- ed to the wind-flow pattern dur- the spring. The significance of s finding cannot be stated with tainty, but there is a logical basis r the association in that variations the winds alter the hydrographic structure around the Hawaiian Islands.

A report describing and analyzing the results of POFI's 1953 equatorial tuna surveys was issued. Among the highlights of this report was the clear demonstration that in the central Pacific small surface yellowfin are closely associated with islands and are relatively scarce in the open ocean. In addition there was clear evidence that the center of abundance of deep-swimming tuna along the Equator shifts considerably from east to west. For instance, during April they were most abundant at 140° W. and during May they were most abundant at 170° W., a shift of 1,800 miles. ✶

Value of Alaskan Salmon

The arrival of 7,500 tons of canned salmon on the Alaska Steamship Company steamer Tonsina, the largest single cargo out of Alaska for some time, was celebrated at Pier 24 in Seattle recently.

The Tonsina's salmon cargo, 346,387 cases—15,211,360 tons—was valued at nine and one-quarter million dollars. That exceeds by more than two million dollars the purchase price of the Territory of Alaska, an area of over 590,000 square miles. The United States paid Russia $7,200,000 for it in 1867.

Another interesting comparison: the ton of gold that arrived in Seattle aboard the steamer Portland on July 17, 1897, sparking the Alaska gold rush, was worth only $1,120,000 at today's $35-an-ounce pegged gold price.

Most of the Tonsina salmon came from Bristol Bay, the main red salmon producing area of Alaska.

The Tuna Industry in Australia

(Continued from page 6)

been offered to Australian consumers. It is probable that a substantial advertising campaign would be necessary to dispose of large quantities. But tuna should quickly become accepted.

The void created by non-availability of North American salmon has never been filled, for sardines, herrings, etc., are not usually regarded as fully competitive with solid pack fish such as salmon or tuna. In 1935-36, the peak year, Australia imported 16,399,178 pounds of North American salmon. Thus there is a large potential local market for tuna as a replacement for salmon.

The markets for raw tuna in U.S.A. are open, subject to shipping facilities. Southern Bluefin would probably command the same price as yellowfin. This rate is about double the price paid to fishermen in Australia and gives promise of a substantial profit to shippers after meeting transport costs. The U.S. Tariff Commission recently rejected an application for a duty on raw tuna, and there is no indication that a duty is likely to be imposed in the forseeable future.

The U.S. Bureau of Customs has determined that foreign fishing vessels are not prohibited from landing in American Samoa fresh or frozen fish taken on the high seas, or transferred on the high seas from a foreign flagship. Fish processed in American Samoa becomes the product of American Samoa and can enter U.S.A. duty free. So Australian tuna boats operating in northern waters would have an alternative landing place for tuna in the round.

Costs

Costs of canning tuna in Australia are naturally very high in view of the spasmodic nature of supplies, and by comparison with American canneries, lack of modern mechanized equipment and smallness of turnover, making mass production methods impractical. Costs will be reduced when quantity and flow are improved, and as canneries grow in size and become more mechanized.

As the industry grows in size, too, the fish can be utilized more fully. Some Australian canneries already have fish meal plants. The heads, tails, fins, skins, dark meat and viscera can all be processed to produce fish meal and oil. Since 1930, American canneries have produced tuna liver oil which has high potency vitamins A and D. Fish solubles are obtained from the press liquor extracted from waste, and a liquid fertilizer is also made from waste. ✶

Why Do Fishery Stocks Fluctuate?

(Continued from page 11)

months of life along shore. The temperature range of sardines (about 12° to 20° C.) is intermediate between that of the menhaden and that of the herring.

Pacific salmons can exist only where there is a peculiar combination of stream conditions and of oceanic conditions, as proved by the fact that although their eggs have been transplanted to many parts of the world, Pacific salmon have taken hold only where environmental conditions approximate those of the North Pacific, i.e., New Zealand, Chile, Maine, New Brunswick. In streams, the optimal temperature conditions for the incubation period are somewhere between 4° and 11° C. Eggs suffer severe mortalities if subjected to excessive periods outside those limits. After hatching, the optimal temperature range which controls the growth and survival of the young lies between 13° and 17° C. Prolonged periods beyond these limits cause excessive mortailities among the young. In the ocean, salmon seem to be limited during their spawning and seasonal migrations to a temperature zone at the surface of about 0° to about 20° C.

Variations in the weather and in the speed and location of ocean currents, and possibly in the amount of soil and dissolved material carried to the sea by the rivers bring about wide variations in the fertility of the sea's green pastures. We have some evidence for this in the observed fluctuation of the annual crop of plant plankton in different regions. Other evidence comes from fluctuations in the numbers of young fish before they are old enough to be caught by the fishermen. Most fish of the high seas spawn so many eggs that it is difficult to believe these fluctuations in young fish numbers can be due, except in cases of extreme depletion of the spawning population, to fluctuations in the number of adults. Perhaps it is better to say that the variations in the amount of available food and in the numbers of predators and competitors are so great as to mask any relationship between the numbers of adults and the size of a new year class.

Variations in the strength of the new year class, not apparently related to the size of the parent stock, have been observed in many fisheries; for example, the Atlantic, Pacific and Japanese herring, the North Sea plaice, the Atlantic haddock and cod, and the California sardine. In most instances we are not sure whether these are brought about by actual changes in fertility, by some other process related to the ocean circulation, or by little understood biological factors.

Fluctuations in the adult population—that is, the rate of natural mortality—may also be related to variations in the food supply—that is, the fertility of the water. The unexpected decline in the catch of Alaska pink salmon in 1953 could well be an example.

Perhaps of greater importance, both to the fish and the fisheries, than the variations in fertility of a particular region, are the fluctuations in the weather and in ocean currents, and the accompanying changes in the temperature and other properties of the water. Just as the elk of the plains and the caribou of the tundra live in a well-defined climatic region and migrate north and south as climates change, so each species of fish has a limited range of tolerance to the ocean climate.

Moreover, even though the fish can swim fast and well, their movements seem to be affected by the ocean currents. Consequently, the distribution of a fish population may change as the currents change. But the locations of the areas of high fertility are not much affected by the currents. Thus, both the adults and the young fish may be carried out of regions of high fertility and good food supply into a harsher environment, where many of them must starve or be weakened in vitality so that they become easy victims to predators. There are no fences around the green pastures of the sea.

For example, one of the principal factors bringing about recent poor year classes of California sardines may be changes in the ocean currents off the California coast. During the years when the young sardine population was large, a pronounced counter-current flowed northward between the shore and the southward moving California Current. The counter-current has been weak or absent during the last few years, and the current of population of both the adult and young California sardines has shifted southward far down the coast of Lower California.

The fertility of this area is probably much less than that of the waters off California, and it is likely that at least some racial groups of the sardine population have greatly dim- ished in numbers. In the Atlant variations of year class strength plaice, herring and other species ha been shown by Jensen to be cor lated with fluctuations in the cu rents between the North Sea and t Baltic.

In addition to their effect on pop lation size, changes in water tempe ture and ocean currents may pr foundly affect the success of a fis ery in another way: by making t fish more or less available to t fishermen. From the point of view the fishermen, we may divide the fluctuations in temperature and cu rents into two classes: long-ter changes and short-term changes.

The increase in the cod fishery Greenland during the last 40 years a classical example of a benefic effect of a long-term change in oce temperature on the fisheries. Here t average water temperature increa by nearly 2° F. during the 20 yea 1906 to 1926, and is still consid ably above the average for the mi dle of the last century. This increa in ocean temperature has been acco panied by a great northward migr tion of the cod.

Off Southern and Lower Calif nia, the average air temperature, a presumably the water temperatu decreased by about 2° F. from 18 to 1900, and has apparently sin slightly increased. Several species warm-water fishes were abundant c San Diego in the 1850's and ha only rarely been seen since that tim

Fluctuations in the temperatures the waters off Japan and presumab in the position of the Kuroshio a Oyashio currents are closely cor lated with the success of the Jap nese sardine and herring fishery. I terestingly enough, when the sardi fishing is good, the herring fishing poor, and vice versa. This sugge that when the southward flowing Oy shio Current is displaced to the sou along the Japanese Coast, and co sequently the water temperatu cools, the sardines move south out the normal fishing grounds but a replaced by the herring coming from the north.

Last year the warm water of t eastward flowing equatorial counte current turned southward along t coasts of Ecuador and Peru, bringi heavy rains and floods on shore a causing extensive changes in t ocean environment, resulting in ma killing of fish, the deaths of cou

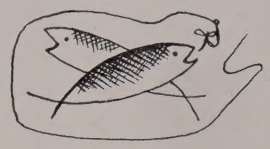
ess thousands of guano birds, and a very sad year for the California tuna ishery. This disastrous shift in the urrents occurs, on the averoge, once very 30 years, and is called el Nino the child) because it usually hapens about at Christmas-time.

It is more than natural to ask whether fluctuations in ocean currents and temperatures can be predicted, for if this were possible, many millions of dollars could be saved by both the fishermen and the processors. Unfortunately, we do not know enough at the present time either about the ocean or the atmosphere to be able to predict changes from year to year.

Because fish usually take several years to grow up, we have a hope of developing a useful prediction system for variations in the size of populations if what happens to the young fish is important in determining the number of adults. On the other hand, in order to predict where the fish will be a year or so in advance, that is, the locations of populations, it will be necessary to find some relationship between the weather and the currents, in which what happens to the weather today will affect the currents several weeks or months, or preferably years from now. We have at least a glimmering of a relationship between world-wide weather phenomena and fluctuations in the ocean currents.

Scientific and engineering progress may have considerable value to the fishing industries. By observation, we may help to discover new fisheries resources. The deep tunas found by the Pacific Oceanic Fisheries Investigations south of Hawaii, the king crabs of Alaska, and the shrimp off the Atlantic Coast are examples of new resources discovered by observation. If we can gain understanding of why fish populations change, we may be able to estimate the effects of man on the fisheries and thus to establish useful management measures, of value to all. Through understanding based on observation, we may be able to develop means of prediction which will help in industry planning. Finally it is by no means impossible that we shall learn eventually to control some aspects of the ocean. I am thinking here primarily of the possibility of increasing the fertility of the green pastures of the sea.

Ten years ago I would have said that this was impossible or at least economically unfeasible. For example, I believed that the fertility of the California waters depended upon the phosphate and nitrate brought up to the lighted zone by up-welling. This amounts, at a minimum, to several hundred thousand tons of phosphate a year. But recent work suggests that the fertility actually depends on substances present in very much smaller concentrations than the phosphate. It may be that the total amount of these substances needed to double the fertility of the California waters each year is only one or two thousand tons, and if so, we might eventually by a relatively small expenditure, be able to add these substances to the water and thereby to increase greatly the yield of the California fisheries.*



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